

Power in Legislative Bargaining:
Theoretical conception and empirical
application to the European Union

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Power in Legislative Bargaining: Theoretical conception and empirical application to the European Union

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by

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Starting from the fundamental criticism of the application of power indices to the European Union by Garrett and Tsebelis (1999) the paper derives the classical power indices in a non-cooperative game-theoretical framework. In detail, a simplified version of the Baron/Ferejohn (1989) model is suggested assuming legislators are generally uncertain about the policy preferences of other legislators. The ex ante expected outcome of the non-cooperative legislative bargaining process is a lottery of proposals. Confronted with this lottery political agents informally agree ex ante on a deterministic proposal

procedure, where a common mean voter proposal corresponding with a weighted mean of agent's ideal points is opposed vis-à-vis the status quo in final vote. In particular, the final mean voter proposal is derived in a centralized political exchange mechanism, in which legislators demand for individual weights regarding various dimensions of a multidimensional policy proposal. Within the political exchange approach political power is conceptualized as legislators' political market power to demand for individual weights over political dimensions highly valued in the legislative system. The following results are proved: (i) A Walras equilibrium exists for the exchange mechanism taking external effects explicitly into account. (ii) Under specific conditions political power of legislators correspond with the Shapley/Shubik or normalized Banzhaf-Power Index, respectively. (iii) In equilibrium actors ability to determine the final policy outcome can be subdivided into an institutionally determined real power component and a preference determined luck component corresponding to the externalities of political exchange of other legislators. (iv) the model is empirically supported by an application to the European Agricultural Policy.

Key words: formal modeling of legislative process, non-cooperative game theory, power indices, political exchange, abstract economy, European Union

JEL: C63, C72, D58, D 72, D78

1 Introduction

There is an on-going discussion on the application of power indices to European Union (see special issue of JTP 1995, 1999, 2001 Tsebelis/Garrett 1996). In general our paper is addressed to this discussion, but we do not intend to refer to all details of the discussion. Rather we like to focus our analyses on more general aspects of power indices and formal modeling of legislative decision-making process raised by the dispute among the authors.

In particular, Garrett and Tsebelis (1999) argue against the application of voting power indices in the EU. Their main argument is twofold. First, classical concepts of voting power indices, i.e. Banzhaf and Shapley-Shubik indices, do not take into account important institutional rules of the legislative decision-making process within the EU-system, e.g. agenda setting power. Second, classical voting power indices ignore policy preferences of relevant political actors, e.g. national members in the council, the commission and parliamentary groups in the EP. Moreover, Garrett and Tsebelis criticize simple cooperative voting games as inappropriate models and suggest non-cooperative game theoretical models, i.e. an agenda setting model, to analyze legislative decision-making within the EU-system (Garrett and Tsebelis 1999: 291).

In contrast to Garrett and Tsebelis, scholars supporting the application of classical power indices to the EU argue that the analyses of a priori voting power make important contribution especially to constitutional choice theory (Lane and Berg 1999, Holler and Widgrén 1999 and partially also Steuenberg et al. 1999 and Felsenthal and Moshé 2001). This argumentation goes back to Shapley and Shubik (1954) who emphasize the usefulness of power indices analyzing the “..[b]asic design in of legislative assemblies and policy-making boards”. Analogously Coleman (1971, reprinted in Coleman 1986: 192) stated that “[T]he distribution among the members of formal control over a collectivity’s actions is an important element of

constitution. The exercise of such control is mediated by decision rules, which may be very complex, involving preliminary decisions by sub-collectivities within the larger collectivity. Framers of constitution pay very special attention to distribution of control and to the form of decision rules, for these determine in large part the power of various members of the collectivity...". Additionally, Lane and Berg as well as Holler and Widgrén argue against Garrett and Tsebelis that voting power models are the right approach to model ex ante legislative decision-making, e.g. when no specific policy issues exist and hence individual policy preferences are unknown, while non-cooperative models are the right models for ex post analyses, when concrete policy issues exist and preferences are known.

It is argued in the paper that both groups of authors might be partially right. On the one hand Garrett and Tsebelis are right in demanding generally that any analysis of legislative –decision-making should be based on a positive model of the legislative decision-making process. Moreover, results derived from a model can only deliver any insights into real decision-making if the model fits empirically observed legislative decision-making process. Therefore, as far as it can be demonstrated that legislative decision-making in the EU cannot be modeled within simple voting games, Garrett and Tsebelis are correct in criticizing these approaches. On the other hand, it is always possible to conceptualize power of individual actors engaged in social situations, in particular legislative decision-making. Moreover, analyzing political power of individual actors based on positive models of legislative decision-making is an interesting and important endeavor, especially in the framework of normative and positive constitutional choice theory (Shapley and Shubik 1954, Coleman 1971, Weingast et al. 1981, de Figueiredo and Weingast 1998).

Hence, while scholars of political voting power models do provide a measurement concept of ex ante voting power which might possibly be the wrong one for the EU, they certainly do not provide a positive model of legislative decision-making which

allows for empirical testing. Contrary, Garrett and Tsebelis (1999) do provide positive models of legislative decision-making that generally could be tested and applied empirically to the EU-system¹. But, they do not provide any concepts like ex ante voting power relating their models with the problem of constitutional choice. This is particularly regrettable since beyond positive analyses of concrete decision-making within given institutional environment a comprehensive positive analysis of legislative decision-making should include an explanation of the choice of institutional settings. Hence, it is not surprising that positive constitutional choice theory gains increasing interest in positive political theory (see de Figueiredo and Weingast 1998).

Thus, to conjoin both lines of argumentation, in this paper a model of legislative decision-making will be defined that according to the premises of Garrett and Tsebelis is based on non-cooperative game theory and simultaneously allows for a derivation of political power indices. Moreover, we will demonstrate that this model can be applied to the EU predicting pars pro toto real policy outcome of the European Common Agricultural Policy (CAP), while for the agenda setter model only a poor empirical support can be observed.

The paper is structured as follows. We will first provide a general conceptualization and definition of individual political power in section 2. Especially, individual political power will be systematically distinguished from the concept of luck. In section 3 our model of legislative decision-making is derived in two steps. In a first step following the premise of Garrett and Tsebelis we generally interpret legislative decision making as a non-cooperative game. In contrast to Garrett and Tsebelis, we follow Blin and Satterthwaite (1977) assuming that individual policy preferences are private information. Following Weingast (1979) we include both constitutional rules and informal norms derived in the shadow of these rules as relevant institutions

¹ Although so far as we know they hardly provided real empirical tests of their models.

determining the equilibrium of the legislative game². In detail, under these assumptions we derive a simple non-cooperative legislative bargaining game (NLG) corresponding to the non-cooperative bargaining game of Baron and Ferejohn (1989) to show the following results: (i) The equilibrium outcome of the NLG corresponds to a lottery over legislators' ideal points and the status quo. (ii) The probability that the ideal point of a legislator i is the final outcome of the game is determined by the constitutional rules of the legislature. The relative individual probability of a legislator can be interpreted as her political power and hence defines her political power index. (iii) On the basis of NLG, power can be systematically distinguished from luck, the latter defined on the basis of individual expected utility corresponding with the lottery of other legislators' ideal points and the status quo. (iv) Further, specific conditions are identified under which political power defined in the framework of the NLG equals the classical Banzhaf and Shapley-Shubik voting power index, respectively.

In a second step we demonstrate that there exists a political exchange game (PEG) that dominates the NLG, i.e. leads for every legislator to a higher value (ex ante expected utility). According to the PEG, legislators informally agree ex ante on a common proposal procedure, where the common proposal opposed vis-à-vis the status quo in final vote corresponds with a weighted mean of agent's ideal points. In equilibrium of the PEG actors' ability to determine the final policy outcome can be subdivided into an institutionally determined real power component and a luck component corresponding to the externalities of political exchange of other legislators. Moreover, it will be shown that political power defined in the framework of PEG generalized the power concept defined in the framework of the NLG.

² Interestingly, also Shapley and Shubik underline the importance of informal rules and norms for the outcome of real decision-making. Although they conclude "[I]t would be foolish to expect to be able to catch all the subtle shades and nuances of custom and procedure that are to be found in most real decision-making bodies." (Shapley/Shubik 1954: 791).

Beyond theoretical considerations section 4 delivers empirical evidence for our claim that the political exchange game is an appropriate approach to model legislative decision-making within the EU-system. In particular, empirical evidence is derived from an empirical application of the PEG to the European Common Agricultural Policy that results in a convincing support of the PEG compared to a poor performance of the agenda setter model, that has been suggested by Garrett and Tsebelis. Section 5 summarized our main findings.

2 On the concept of (political) power

Although power is a widely used concept in social sciences, there exists no unique definition of power. The most promising starting point is Weber who defined power of an individual actor in a specific social situation as the probability that this actor will determine the outcome of this specific social situation even against the will of other actors (Weber 1921). To formalize Weber's conception of power we define a social situation as an abstract game (denoted SG hereafter) played by a set of actors N . Each actor $i \in N$ has a specific action set A_i from which she can choose her individual action strategies $a_i \in A_i$. The outcome α is defined as a function of the individual action strategies: $\alpha = \alpha(a)$, where $a = \{a_1, \dots, a_n\}$ denotes the vector of individual action strategies. Moreover, every actor has a pay-off function defined over the outcome α $U_i(\alpha)$. Further, we assume that a Nash equilibrium of the game exists and denote it a^* . Accordingly, we consider the outcome $\alpha^*(a^*)$ corresponding with this Nash equilibrium as the outcome of the game. Furthermore, we assume that for each actor exists an ideal point y_i defined as the maximand of $U_i(\alpha(a))$ over the total strategy space $A = \prod_{i \in N} A_i$. Given the final set of actors' ideal points, Y , a zero point for every actor z_i can be defined as the minimum of $U_i(\alpha)$ over Y .

To introduce Weber's concept of power we assume that the outcome α^* is a lottery over actors' ideal points. Let P_i denote the probability that the ideal point of an actor

i will be the outcome³. Then, the power of an actor i corresponds to the probability P_i . Next we can define the individual value of the game SG (v_i^{SG}) as actors' expected utility for the equilibrium outcome α^* :

$$(a) \quad v_i^{SG} = EU_i(\alpha^*) = \sum_{k \in N} P_k U_i(y_k) = P_i U_i(y_i) + (1 - P_i) \sum_{k \neq i} \frac{P_k}{\sum_{h \neq k} P_h} U_i(y_k)$$

As the pay-off function is cardinal we always can transform this function in a way that $U_i(y_i)=1$ and $U_i(z_i) = 0$. Hence, given this transformation of individual pay-off functions, we can define another set of games, which we call "games against the will of other" (AWGⁱ) for all $i \in N$. By definition, for any $i \in N$ AWGⁱ corresponds exactly to SG except the assumption that all actors $k \neq i$ have an ideal point $y_k = z_i$. Hence, AWGⁱ can be interpreted as a formalization of what Weber describes as "against the will of other".

Finally, we can systematically define luck as the difference between the value of the social game v_i^{SG} and the value of the AWGⁱ (v_i^{GAW}). Given the definition of the pay-function this difference corresponds with the amount of power an actor i would additionally need in a game "against the will of other", so that the value of the (transformed) AWGⁱ equals the value of the social game SG actually played. We shall denote this difference by L_i^{SG} . Hence, in a game SG individual power is measured by P_i^{SG} and luck by L_i^{SG} .

Next we want to relate the concepts of power and luck, respectively, with the problem of constitutional choice. Therefore, let Γ and M^u denote a set of rules and a set of preference profiles, respectively. An element $\gamma \in \Gamma$ defines the rules of a game of type SG, while an element $u \in M^u$ is a vector of individual pay-off functions defined for the actors $i \in N$. Then, $SG(\gamma, u)$ denotes the game defined by the rules γ and the

³ Alternatively, one could assume that the outcome corresponds with the weighted mean of ideal positions. Accordingly, individual power is then defined as the weight of actors' ideal position. See also

preferences. Now given that Γ has more than one element, a constitutional choice problem corresponds with the selection of a concrete element of Γ .

How can we model a constitutional choice problem? A first starting point is Weingast (1979) interpreting constitutional choice as "legislators choosing the rules of the game to maximize their expected benefits". Thus, applying Weingast's approach actors' individual constitutional choices depend on the value of the game $SG(\gamma, u)$, analogously we denote this value $v_i^{SG}(\gamma, u)$. Given the exposition above it holds for a given u and γ :

$$(b) \quad v_i^{SG}(\gamma, u) = L_i^{SG}(\gamma, u) + P_i^{SG}(\gamma)$$

We do not want to define a complete constitutional game here, but obviously it holds that an equilibrium of such a game (γ^*) depends on the individual values actors relate with the different games $SG(\gamma, u)$. Hence, according to eq.(2) these values directly depend on actors' power and luck. Therefore, it follows quite plainly that any constitutional choice problem can be analyzed on the basis of power and luck related with the different games actors can play. Finally, it is a common assumption that constitutional choices are made under the veil of ignorance, that is actors do not know their specific preferences when they have to choose γ^* ⁴. Hence, to take this specific assumption into account one can assume that after actors have chosen the rules of the game γ^* , nature has a last move selecting randomly an element u^* out of the set M^u according to a probability distribution $f(u)$. Assuming actors know the probability distribution $f(u)$ when choosing the institutional rule implies that actors choices depend on the expected values of the games $SG(\gamma, u^*)$. Denote these expected values by $Ev_i^{SG}(\gamma, u^*)$ results in:

section 3 below.

⁴ An alternative approach is to assume specific stylized individual preferences for the different actors, that are typical for the kind of social situation analyzed (see for example Persson, Roland, Tabellini 2000).

$$Ev_i^{SG}(\gamma, u) = \int_0^1 [L_i^{SG}(\gamma, u) + P_i^{SG}(\gamma)] f(u) du = EL_i^{SG}(\gamma) + P_i^{SG}(\gamma)$$

(c)

$$\text{with : } EL_i^{SG}(\gamma) = \int_0^1 L_i^{SG}(\gamma, u) f(u) du$$

A strong interpretation of the veil of ignorance would be that the term $EL_i^{SG}(\gamma)$ which can be interpreted as the expected luck in a game $SG(\gamma)$ is the same for all $\gamma \in \Gamma$. Then, it follows directly from eq. (3) that the constitutional game is completely determined by actors' institutionally determined power.

Overall, the analyses provide a clear concept of power in social situations. Further, the concept of power is systematically distinguished from luck. Moreover, it has been demonstrated that constitutional choices can generally be analyzed in terms of power and luck. In particular, under a strong interpretation of the assumption of the veil of ignorance, constitutional choices can be analyzed exclusively in terms of power. Thus, as long as legislative decision-making corresponds to the type of social game SG as defined above, our expositions directly justify an application of political power concepts in the framework of constitutional choice theory. What is left to show is how concepts of political power relate to positive analysis of legislative decision-making.

In the following section we first will derive a non-cooperative game of legislative decision-making (NLG) that corresponds c.p. to the structure of the social game described above. Therefore, the derived concepts of power and luck can be analogously applied. Next we will define a political exchange game (PEG) and proof that the political exchange game dominates the NLG in the sense that ex ante expected pay-offs are higher for all legislators. Moreover, we argue that the PEG provides a positive model of legislative decision-making, in particular within the EU, and that in the framework of the PEG a generalization of the concepts of political power and luck can be developed.

3 Power indices and modeling of legislative decision-making

Following Baron and Ferejohn (1989) we consider a legislature comprising n legislators $N=\{1,\dots,n\}$ and constitutionally fixed majority voting rule ϕ . The legislature has collectively to choose an alternative α out of a compact and convex subset R^m of the m -dimensional cube $(0,1)^m$. Each legislator $i \in N$ has a complete, transitive binary preference relation, $>_i$, defined for all $\alpha, \alpha' \in R^m$, that is represented by an ordinal and concave utility function $U^i(\alpha)$.

Formally, the rule ϕ corresponds to a binary choice procedure $C(\alpha, \alpha')$ which determines that legislature chooses among two alternatives α and α' and a random recognition rule that determines which legislator can make a proposal. In general, the random recognition rule can be represented by a vector of individual probabilities $q=q_1, \dots, q_n$, where q_i denotes the probability that legislator i is chosen to make a proposal. For simplicity we assume in the following that $q_i=1/n$ for all $i \in N$. The choice procedure $C(\alpha, \alpha')$ can be represented by a set G of winning coalitions. A winning coalition $g \in G$ is defined as an element of the superset 2^N , for which the following holds: if all members of g prefer an alternative α in comparison to an alternative α' , then legislature prefers the alternative α to α' .

Let s denote the status-quo policy. A necessary condition for a change of the status-quo policy is the existence of a winning coalition g whose members uniquely prefer an alternative α to the status quo s . Let $W(s) \subseteq R^m$ denote the subset of alternatives α , for which a winning coalition exists that prefers α to s . A general characteristic of legislative decision-making is that $W(s)$ is generally a large subset of R^m and there exists a large number of different winning coalitions preferring different alternatives to the status quo. Moreover, constitutional rules do neither determine which winning coalition has to form nor which element of $W(s)$ has to be proposed.

In this context Baron (1994) as well as Banks and Duggan (1998) assume that the final selection of an alternative $\alpha \in W(s)$ is a non-cooperative bargaining procedure among legislators determined by the following rules. At a first stage an individual legislator $i \in N$ is selected by a randomized recognition rule to propose a specific alternative and at a second stage the selected legislator has to form a stable winning coalition for his proposal. If a selected legislator succeeds in forming a winning coalition for his proposal, this proposal is the new policy, otherwise a new legislator is selected and the procedure starts from the beginning.

Assuming individual preferences are common knowledge, Banks and Duggan (1998) have shown that the non-cooperative bargaining game has a stationary solution even for multidimensional policies and multiple legislators, i.e. $m, n > 1$.

In contrast, many scholars of legislative decision-making assume that individual policy preferences are private information. For example, Blin and Satterthwaite (1977: 881) underline "[T]herefore, a realistic analysis of voting behavior must accept that a member's true preferences are private", and Wilson (1967) even stronger concludes that most of the legislative institutions would be superfluous if individual policy preferences were common knowledge.

Assuming policy preferences are private information implies that individual legislators have to form specific beliefs regarding the policy preferences of other legislators. Under these assumptions it can be shown that from legislators' perspective sequential equilibrium in general becomes inefficient (see for example Blin and Satterthwaite 1977).

In this context we assume a rather simple process of the formation of individual beliefs regarding other legislators' preferences. In detail, we assume that each legislator $i \in N$ suggesting a proposal expects that any other legislator $j \in N$ will join a winning coalition supporting his proposal with a specific probability (p_{ij}) , where the exact probability is not known by a legislator i . Instead he only knows the distribution

f^{ij} of this probability p_{ij} . Of course, the distribution f^{ij} generally will depend on the proposal x_i made by a legislator i , i.e. $f^{ij}(x_i)$. To simplify analyses we make the following specific assumptions regarding the formation of legislators' expectations. Legislators commonly know a set $H(s)$ that includes the win set $W(s)$, i.e. it holds: $W(s) \subseteq H(s)$. For any point x not in $H(s)$ it holds: $f^{ij}(x) = 0$ for all legislators $i, j \in N$. For any point $x \in H(s)$ the probability distribution f^{ij} is the same for all proposals $x \in H(s)$ and for all legislators $j \in N$, that is regarding the expected probability that another legislator j will support her proposal a legislator i can not distinguish between different proposals of the set $H(s)$. In more specific terms we assume for any pair of legislators that the distribution f^{ij} is uniform over the $[0,1]$ -interval for all $x \in H(s)$ ⁵⁶.

It is beyond the scope of this paper to derive the assumed probability distributions analytically from a specific modeling of belief formation⁷. Note that in essence the assumptions made above correspond with a specific elaboration of the fact that legislators' policy preferences are private information. Generally assuming private information implies that the process of forming a winning coalition for a given proposal is ex ante uncertain for an individual legislator. Basically, the following expositions rest on especially this implication of private information and will therefore not change in substance when another and more sophisticated modeling strategy will be applied to legislators' belief formation. On the other hand the simplifying

⁵ Of course, given any specific proposal the expected probability P_{ij} depends on the policy preferences of legislator j . But to take strategic advantage of this general property a legislator has to know these preferences.

⁶ Assuming legislators can be positioned in an ideological space would imply that ideal positions of legislators are correlated according to their ideology. Hence, ideology would allow legislators to form individually specific expectations on the probabilities P_{ij} . Note, that also the assumption of individually specific probabilities P_{ij} would not change substantially the results derived in the following.

⁷ A more sophisticated modeling of belief formation would be to assume that legislators' decision to join a winning coalition can be derived from maximizing a probabilistic utility function. Under this assumption, legislators' choice of a proposal x can be directly modeled within expected utility maximization.

assumptions made have two advantages. First, the outline of argumentation is simplified and secondly empirical application is facilitated.

Finally, we assume that in general the time to draw a legislative decision is limited. This implies that legislature will not infinitely consider proposals regarding a specific decision. Thus, ex post the number of proposals that have been made is always limited, while the number of proposals that will be considered is ex ante not known by individual legislators. Therefore, it is assumed that after each round there exists a fix probability p_T that a next round will occur. Thus, after each round the legislative decision procedure stops with a probability $(1-p_T)$ and the status quo policy sustains. We assume that the organization of legislature, including the voting rule φ and the random recognition rule, the set $H(s)$, the probability p_T and the individual probability distribution p^{ij} are common knowledge to all legislators.

Under these assumptions the legislative process can be understood as a non-cooperative game of winning coalition formation corresponding to the game tree given in figure 1 below. To be clear: the non-cooperative legislative bargaining game in figure 1 describes legislative decision-making ex ante under the veil of ignorance. Therefore, it follows that individual legislators do not know their own specific policy preferences, i.e. set ex ante their information on their own preferences is incomplete.

- figure 1 -

Given the infinite form of the game we cannot directly derive subgame-perfect Nash equilibrium using backwards induction. Therefore, following Baron and Ferejohn (1989) we could analyze stationary equilibria. As is shown in proposition 1 it follows directly from the simple structure of the game that a stationary subgame-perfect equilibrium of our legislative bargaining game is defined by the following pure

strategy configuration: a recognized legislator proposes the maximand of the utility function $U_i(\alpha)$ over $H(s)$. Let x_i denote this maximand. Obviously, as long as x_i is unique for each legislator, the stationary subgame perfect Nash equilibrium is unique.

As is shown in proposition 1 we further can characterize the stationary subgame-perfect equilibrium of the winning coalition game in the following way. There exist fixed ex ante probabilities Q_s and Q_i , respectively, that the status quo and the individual proposals x_i will be the outcome of the legislative decision. Hence, the ex ante outcome of the legislative bargaining game is a lottery over legislators' proposal x_i and the status quo s , where Q_s is the probability of the status quo and $(1-Q_s) C_i$ is the probability of the proposal x_i . C_i corresponds to the relative probability that the proposal of legislator i will be the final outcome and is completely determined by constitutional voting rule ϕ .

Accordingly, assuming for simplicity a discount factor of 1 for all legislators the value (v_i) of the legislative bargaining game is given for a legislator i by:

$$(1) \quad v_i = (1 - Q_s) \sum_k C_k U_i(x_k) + Q_s U_i(s).$$

Proposition 1: Assuming for all legislators a discount factor $\delta=1$ a configuration of pure strategies is a stationary subgame-perfect Nash equilibrium of the infinite session legislative game if and only if it fulfills the following condition: (i) a recognized legislator proposed x_i , the maximand of his utility function over $H(s)$. (ii) The ex ante probability Q_i that the proposal x_i will be the final outcome of the legislative game is given by

$$(2) \quad Q_i = (1 - Q_s) \frac{g_i}{\sum_k g_k},$$

where Q_s denotes the ex ante probability that the status quo will be the final outcome of the legislative decision and g_i denotes for every $i \in N$ the number of winning coalitions, in which i is a member. (iii) In particular, it holds for Q_s :

$$(3) \quad Q_s = \frac{(1 - p_T) \left(1 - \frac{0.5^n}{n} \sum_k g_k \right)}{1 - p_T + p_T \frac{0.5^n}{n} \sum_k g_k}$$

(iv) The ex ante values of the game v_i are determined by:

$$(4) \quad v_i = (1 - Q_s) \sum_k C_k U_i(x_k) + Q_s U_i(s)$$

The proof of proposition 1 is given in the appendix.

Definition and measurement of political power in the framework of the NLG

Thus, according to proposition 1 the structure of the NLG corresponds with the structure of the SG defined in section 2 above. Therefore, we directly can apply the concepts of power and luck defined in section 2. Hence, political power of an individual legislator i corresponds to the ex ante probability Q_i that he succeeds in forming a winning coalition. Obviously, given this definition it follows that as long as $Q_s > 0$ the set of legislators does not completely control legislative decision-making. Thus, following Coleman (1986) $(1 - Q_s)$ can be interpreted as the power of the legislature to act as a collectivity. Note that legislature's power to act as a collectivity corresponds to the ability of legislature to change the status quo policy. According to eq. (3) this ability is completely determined by the constitutional rules. Further, one might consider the relative political power, i.e. the conditional probability that the outcome of the legislative decision-making is the ideal position of legislator i given the condition that legislature acts, i.e. actually changes the status quo policy. The relative political power is defined by the relative probability C_i :

$$(5) \quad \frac{Q_i}{\sum_k Q_k} = C_i = \frac{g_i}{\sum_{k \in N} g_k}$$

According to eq. (5) legislator's relative power to act depends on the number of winning coalitions in which he is a member in relation to the total number of winning coalitions individual legislators are members in. Note that the measure of relative political power corresponds to the relative inclusiveness, where inclusiveness is a apriori voting power concept defined by Bräuninger (see Bräuninger 1996 as well as König and Bräuninger 1998).

Analogously, an index of individual voting luck L_i can be defined according to the exposition made in section 2 :

$$(6) \quad L_i = v_i - Q_i = \frac{(1 - Q_s)}{\sum_{h \neq i} C_h} \sum_{k \neq i} C_k U_i(x_k) + Q_s U_i(s)$$

According to eq. (6) a legislator is the more lucky the closer c.p. his ideal position lies to the ideal position of relatively powerful legislators and to the status quo, respectively.

Finally, a further comment should be made regarding agenda setting power and political power. So far a random recognition rule has been assumed. In general, one could also assume asymmetric agenda setting power of legislators via assuming different individual values for q_i . Then, eq. (3) results in:

$$(7) \quad \frac{Q_i}{\sum_k Q_k} = C_i = \frac{q_i g_i}{\sum_{k \in N} q_k g_k}$$

According to eq. (7), relative political power is generally determined by the structure of winning coalition and the probability that a legislator is determined to make a proposal. Thus, in general our power index takes asymmetric agenda setting power into account. Note that in the general case our relative political power index no more

corresponds to the relative inclusiveness defined as a priori power indices in the literature⁸.

Further, so far we derived the conditional probability P_i that a selected legislator succeeds in forming a winning coalition for his proposal assuming a uniform distribution for the probabilities p_{ij} (see appendix). Note, that this assumption could also be easily relaxed without changing our main conclusions. In particular, assuming another probability distribution results that legislators' expectations of p_{ij} no more equal 0.5 for any pair $(i,j) \in N \times N$, but generally can take any value between 0 and 1. Hence, it follows for the conditional probability $P_i(\alpha)$:

$$(8) \quad P_i(\alpha) = \sum_{i \in g} \prod_{j \in g} P_{ij} \prod_{k \notin g} (1 - P_{ik}) \quad \alpha \in H(s)$$

$$\text{where : } 0 \leq P_{ik} = \int_0^1 f^{ik}(p_{ik}) p_{ik} dp_{ik} \leq 1$$

The general expression in eq. (8) allows for different probabilities of voting positively and negatively, respectively. Moreover, it can take any a priori knowledge of legislators' policy preferences into account, e.g. knowledge based on legislators' position in an ideological space. Interestingly, a similar conceptualization to eq. (8) has already been suggested by Coleman (1971 reprinted in Coleman 1986: 223-224).

⁸ Moreover, so far it has been assumed that x_i corresponds to legislators' ideal position. In fact x_i is legislators' ideal position defined over the set $H(s)$. But, in general $H(s)$ is a subset of R^m . Now one could alternatively define y_i as the maximand of U_i over the set R^m . Generally, y_i does not equal x_i . Intuitively, the more x_i differs in comparison to y_i the more the agenda setting power of a legislator is restricted. Note that generally, this specific form of individual power restriction could also be introduced into our formal political power index, but as it is not the focus of the paper here, we will not go into further detail. Hence, in the following we simply assume that for all $i \in N$ it holds $y_i = x_i$.

Deriving the classical voting power indices in the framework of the NLG

The normalized Banzhaf-index

Note that relative inclusiveness comes already very close to the normalized Banzhaf index. In contrast to normalized inclusiveness the normalized Banzhaf-Index corresponds to the relative number of winning coalitions in which an individual legislator is a decisive member. A legislator is a decisive member of a winning coalition $i \in g \in G$ if the coalition $g/\{i\}$ is a losing coalition.

Now, as long as we assume that within the legislative decision-making process the formation of winning coalitions actually takes place via voting, i.e. a randomly selected legislator formulates a proposal and all other legislators simultaneously decide to join the winning coalition via voting, decisiveness of the agenda setter does not play a role.

Contrary, let us assume that the formation of a winning coalition does not occur via simultaneous voting, but instead in the following sequential procedure. In a first step, legislators announce their willingness to join a winning coalition. In a second step, the members who announced to join the winning coalition are publicly revealed to all legislators who announced to join the coalition. Given this information the latter legislators can finally decide whether to execute their positive announcement via voting for the made proposal or not. Given these settings we can define a new non-cooperative legislative bargaining game NLG1 corresponding to NLG. NGL1 equals NGL except that in NLG1 the formation of winning coalition follows the two-step procedure described above. Further, it is assumed that legislators generally follow the behavioral norm that they support only winning coalitions via voting if the initiator (agenda setter) is decisive.

We don't want to analyze the equilibrium conditions of the NLG1 in detail, but note that under specific conditions legislature might prefer to play NGL1 instead of NGL. For example, assume there exists a central subset of actors, N^C , for which it holds:

for all winning coalitions $g \in G$ exists at least one member of the subset N^c that is decisive for g , and all members of N^c gain from sustaining the behavioral norm mentioned above, e.g. it holds: $v_i^{NLG1} \geq v_i^{NLG}$. Under these assumptions it follows that N^c prefers playing NLG1 to playing NGL and that the member of N^c can commonly enforce playing NLG1.

As is stated in proposition 2 the equilibrium outcome of NLG1 generally corresponds with the equilibrium outcome of NLG, except the fact that for NLG1 the probabilities Q_i and Q_s , respectively, are functions of the normalized Banzhaf index corresponding to the constitutional majority voting rule φ instead of the relative inclusiveness.

Proposition 2: The NLG1 corresponds to the following equilibrium outcome: (i) the outcome of NLG1 is a lottery over legislators' ideal points (x) and the status quo. (ii) The ex ante probability Q_i that the proposal x_i will be the final outcome of the legislative game is given by

$$(9) \quad Q_i = (1 - Q_s) \beta'_i = (1 - Q_s) \frac{g'_i}{\sum_{k \in N} g'_k}$$

, where β'_i is the normalized Banzhaf index of legislator i corresponding to a simple voting game defined on the basis of the constitutional choice rule φ . Accordingly, g'_i denotes for every $i \in N$ the number of winning coalitions, in which legislator i is a decisive member. (iii) In particular, it holds for Q_s :

$$(10) \quad Q_s = \frac{(1 - p_T) \left(1 - \frac{1}{n} \sum_k \beta_k \right)}{1 - p_T + p_T \frac{1}{n} \sum_k \beta_k} ,$$

where β_i denotes the non-normalized Banzhaf value corresponding to β'_i .

(iv) The ex ante values of the game v_i are determined by:

$$(11) \quad v_i = (1 - Q_s) \sum_k \beta_k U_i(x_k) + Q_s U_i(s)$$

The proof of proposition 2 is given in the appendix.

The Shapley-Shubik index

So far we have assumed that legislators selected to make a proposal from their beliefs assuming other legislators vote independently from each other. Formally, this assumption implies that the probabilities p_{ik} that other legislators k join a winning coalition proposed by a legislator i are independently drawn from uniform distributions f^{ik} . Alternatively, one could assume that legislators' decisions to join a winning coalition are related. For example, following Straffin's homogeneity assumption (1988) we can alternatively assume that the probabilities p_{ik} are drawn from a common uniform probability distribution f . As will be shown in proposition 3 under this homogeneity assumption it follows that the equilibrium outcome of a NLG1 still corresponds with the equilibrium outcome of an NLG, but now the probabilities Q_i and Q_s are functions of the Shapley-Shubik index (ϕ) corresponding to the constitutional majority voting rule φ .

Proposition 3: Under the homogeneity assumption the NLG1 results the following equilibrium outcome: (i) the outcome of NLG1 is a lottery over legislators' ideal points (x) and the status quo. (ii) The ex ante probability Q_i that the proposal x_i will be the final outcome of the legislative game is given by

$$(12) \quad Q_i = (1 - Q_s) \Phi_i$$

, where ϕ_i is the Shapley-Shubik index of legislator i corresponding to a simple voting game defined on the basis of the constitutional choice rule φ . (iii) In particular, it holds for Q_s :

$$(13) \quad Q_s = \frac{(1-p_T) \left(1 - \frac{1}{n}\right)}{1-p_T + p_T \frac{1}{n}}$$

(iv) The ex ante values of the game v_i are determined by:

$$(14) \quad v_i = (1-Q_s) \sum_k \Phi_k U_i(x_k) + Q_s U_i(s)$$

The proof of proposition 3 is given in the appendix. '.

Towards a positive model of real legislative decision-making

Overall, we could demonstrate that under specific assumptions regarding the belief formations of legislators a set of different power indices including the classical Shapley-Shubik and Banzhaf index can be derived in the framework of non-cooperative game theory. Note that so far derivations followed under the general assumption that legislative decisions are made under the veil of ignorance. To be able to test whether these analyses apply to a specific legislative system, e.g. the EU-system, one has to derive a corresponding positive model of legislative decision-making that can be tested empirically. Of course, the NLG corresponds straightforwardly with a positive model of legislative decision-making. A real legislative decision implies that legislators know exactly their own policy preferences. Therefore, legislators' decision to vote positively or negatively on a given proposal will be modeled deterministically via utility maximization. Thus a legislator k will vote positively as long as it holds $U_k(x_i) > v_k$. Note, that in contrast the Baron and Ferejohn model we still assume that legislators do not know policy preferences of other legislators. Therefore, the formulation of a proposal is still a decision under uncertainty as assumed in NLG. Hence, according to this assumption even the outcome of a real legislative decision is uncertain. This uncertainty implies

inefficiency which depending on the degree of uncertainty can be quite high (see Blin and Satterthwaite 1977). In essence, we argue that this anticipated inefficiency makes legislators commonly choose another informal decision-making procedure that reduces inefficiency and dominates the mechanism of non-cooperative bargaining.

In particular, following Henning (2000) we suggest that real legislative decision-making can be modeled empirically by a political exchange game (PEG). Theoretically, the PEG corresponds to an informal decision-making process that is informally derived in the shadow of formal constitutional rules. Further, it can be proved that PEG dominates NLG, i.e. leads for all legislators to a higher ex ante expected utility.

A political exchange approach to legislative decision-making

Obviously, uncertainty of the outcome of the NLG implies inefficiency, that is there always exists at least one common proposal x which ex ante will be preferred by all legislators vis-à-vis the expected outcome of the legislative game, i.e. it holds: $\exists x \in H(s) : U_i(x) \geq v_i \quad \forall i \in N$. Moreover, it will be shown in the following mean voter theorem that there exists at least one universalism legislative game (ULG) including a common proposal procedure that leads for every individual legislator to a higher value of the game when compared to the non-cooperative legislative game described in proposal 1 and thus dominates the non-cooperative legislative game.

Definition 1: Define the following universalism legislative game (ULG): The legislative decision is drawn according to the following three-step procedure. First, a leader of the legislature $L \in N$ is appointed by a random recognition rule. At a second stage every legislator $i \in N$ submits a proposal x_i to the leader. At the third stage the leader chooses the final policy x^M according to the following mean voter decision rule:

$$(15) \quad x^M = (1 - Q_s) \left(\sum_{i, x_i \in H(s)} C_i x_i + x_L \sum_{i, x_i \notin H(s)} C_i \right) + Q_s s.$$

Mean Voter Theorem: Assuming legislators' preferences can be represented by an ordinal and concave utility function $U_i(\alpha)$ and denoting by v_i^{NLG} and v_i^{ULG} the individual value of the universalism and the non-cooperative legislative game, then it holds: $v_i^{ULG} \geq v_i^{NLG} \quad \forall i \in N$. That is ULG dominates NLG for all legislators (e.g. leads ex ante to a higher expected utility).

In essence the proof follows directly from the concavity of legislators' utility functions. Hence, we omit a detailed proof here (for a detailed proof see Henning 2000 or 2001).

Further, applying the mean voter decision rule in an ULG and assuming heterogeneous policy preferences generates gains from exchange among legislators (Weingast/Marshall 1988). In the context of ULG, political exchange corresponds to the desire of individual legislators to increase their individual weight (c_i) for dimensions $j \in M$, in which they are highly interested, in exchange for a lower weight for policy dimensions, in which they are less interested. Therefore, the weight of a legislator i for a policy dimension j can be interpreted as his political control resources c_{ij} over this dimension. Formally, substituting the mean voter x^M into legislators' utility function results in a utility function $V_i(c)$ over political control resources. Denoting the original distribution of individual political control resources by the vector $c^a = \{c^1, \dots, c^j, \dots, c^m\}$, where $c^j = C_1, \dots, C_n$ for all $j \in M$, gains of exchange exist if there exists another feasible distribution of political control resources c^* for which it holds: $V_i(c_i, c_{-i}) \leq V_i(c_i^*, c_{-i}^*) \quad \forall i \in N$. Obviously, $c^* = \{c^{1*}, \dots, c^{j*}, \dots, c^{m*}\}$, is a feasible distribution of control resources if it holds for all j : $\sum_{i \in N} C_{ij} = 1$.

Moreover, applying the mean voter decision rule political exchange results in the following final policy outcome x^{EM} :

$$(16) \quad x^{EM} = \{x_j^{EM}\}, \quad x_j^{EM} = \sum_{i \in N} [C_{ij}^* (X_{ij} (1 - Q_s) + Q_s S)].$$

Obviously, as long as gains of exchange exist the ex ante value of a legislative exchange game (ELG) is for every individual legislator higher than for the ULG. Nevertheless, the core problem of the ELG is the organization of political exchange. As has been extensively discussed in the literature (see for example Weingast/Marshall 1988), in contrast to economic exchange political exchange is plagued by high transaction costs mainly due to the enforcement problem of trades. Thus, the problem is to identify a specific organization of political exchange that beyond a market organization deals with these specific problems and allows political exchange given reasonable transaction costs. In this context Henning (2000, 2001, see also Pappi/Henning 1998) has suggested a specific organization of centralized political exchange that overcomes most of the criticism of existing political exchange models (Coleman 1966, Wilson 1969, Tullock 1970, Weingast/Marshall 1988). In particular, this approach overcomes the enforcement problems inherent in market organization of political exchange and explicitly takes external effects of exchange into account that so far have been neglected by all authors including Weingast and Marshall (1988).

As the focus of the paper is the analysis of power indices we do not derive the political exchange model in detail, but only describe the main points briefly (for a detailed derivation of the model see Henning 2000 or 2001).

Centralized political exchange as an abstract economy

Consider an ULG as defined above. Given the individual policy preferences and the mean voter decision rule, one can define individual preferences $V_i(c)$ over political control resources:

$$(17) \quad V_i(c) = U_i(\alpha), \text{ with } : \alpha = \sum_k C_k \tilde{x}_k \text{ and } \tilde{x}_k = (1 - Q_s)x_k + Q_s s$$

Further, we introduce the following political exchange game:

- a. the leader L determines prices $p = p_1, \dots, p_j, \dots, p_m$ for the policy dimension $j = 1, \dots, m$
- b. each individual legislator can demand political control resources c^{i*} and supplies his control endowment c^{ia} , where the value of demanded control resources cannot exceed the value of supplied control resources: $c^{i*} p \leq c^{ia} p$.
- c. Whenever an exchange equilibrium is reached, e.g. for a given price vector demand equals supply of control resources, the leader formulates the common mean voter proposal which then is opposed in a final vote vis-à-vis the status quo. If the mean voter proposal is supported by a winning coalition according to the majority voting rule φ , it is the final outcome, otherwise the status quo sustains.

Intuitively, given the prices of political control resources each individual legislator wants to allocate his given political control resources over the different policy dimension in such a manner that his utility is maximized. Hence, analogously to classical demand theory each legislator chooses a control vector c^{i*} that maximizes his individual utility given the prices p and his individual control endowment c^{ia} . But, in contrast to standard demand theory we observe external effects of consumption, i.e. according to the mean voter decision rule the individual utility of a legislator i and therefore the choice of c^{i*} depends also on the choices $c^{-i*} = \{c^{1*}, \dots, c^{i-1*}, c^{i+1*}, \dots, c^{n*}\}$ of other legislators $k \neq i$. Intuitively, the higher the demand of control resources of other legislators for a specific policy dimension j , who have ideal points (x_{kj}) that are similar to ideal point of legislator i (x_{ij}) , the lower c.p. will be the demand of control resources of legislator i for this policy dimension j .

Obviously, the individual demand of a legislator i depends on the behavior of other legislators as well as on the prices p , that is on the behavior of the leader. This specific feature can be captured in so-called demand correspondences $B_i(c,p)$ (see Ellickson 1993). Simply speaking, a demand correspondence gives the best reply of a legislator to a given environment, that is given prices and control demands of other legislators. Note that the demand correspondence has essentially the same interpretation as the best response of consumers in a simple Walrasian economy. Next we define the preferences and best response correspondence of the leader L . By definition the main task of the leader L is to derive a political exchange equilibrium, that is to find a price vector p^* for which the best responses c_i^* of all legislators just clear the political market, that is fulfill the following condition:

$$(18) \quad \sum_i c^i - \sum_i c^{ia} = Z(c, c^a) \leq 0$$

Therefore, following Debreu's concept of an abstract economy we assume that the leader analogously to the Walras auctioneer maximize the value of the excess demand function $V_L(c,p)=p^*Z(c,p)$. Then the best response correspondence B_L of the leader is defined as:

$$(19) \quad B_L(c, p) = \left\{ p' \in P \mid p' Z(c, c^a) = \sup_p V_L(c, p) \right\}$$

Definition: An n -tuple $(c^*, p^*) = (c^{1*}, \dots, c^{i*}, \dots, c^{n*}, p^*)$ is called a political exchange equilibrium if it holds: $c^{i*} \in B_i(c^*, p^*)$ and $p^* \in B_L(c^*, p^*)$.

Note, that the political exchange equilibrium extends the Nash equilibrium (see Ellickson 1993: 288), while it also corresponds to a Walrasian exchange equilibrium including external effects. The general proof of the existence of an equilibrium for an abstract economy including external effects is given by Ellickson (1993: 297pp). For the specific application to the PEG see Henning (2000 and 2001).

Moreover, Henning (2000, 2001) demonstrates that the centralized exchange mechanism corresponds to an open centralized political discussion in which legislators find the common mean voter proposal via a tâtonnement process allowing for false trading. Further, it could be demonstrated that the centralized exchange mechanism overcomes the enforcement problem inherent in decentralized political exchange even if sequential exchange is assumed (see Henning 2000 and 2001).

To facilitate the characterization of the equilibrium outcome of the PEG we assume that legislators' utility functions $U(\alpha)$ correspond to the following two stage utility function:

$$(20) \quad U_i(\alpha) = \prod_j (1 - |\alpha_j - X_{ij}|)^{\theta_{ij}}$$

The two stage utility function is a specific nested spatial utility function that implies that on a lower stage legislators' subutility observed for a single policy dimensions j corresponds to a single peaked utility function. On an upper stage subutility for single policy dimensions is aggregated to total utility via a Cobb-Douglas specification, where the coefficient θ_{ij} indicates the relative salience of a legislator i for a policy dimension j .

It follows that the utility function $U_i(\alpha)$ defined in eq. (20) implies the following two-stage Cobb-Douglas specification for the utility function $V_i(c)$:

$$(21) \quad V_i(c) = \prod_j (1 - \mu_{ij} + \mu_{ij} C_{ij})^{\theta_{ij}}, \quad \text{with : } \mu_{ij} = \sum_{k=ii} \frac{C_{kj}}{\sum_{h \neq i} C_{hj}} |X_{kj} - X_{ij}|$$

Proposition 4: Assuming legislators' preferences can be represented by a two-stage Cobb-Douglas specification for $V_i(c)$ as defined in eq. (21). Then, the equilibrium outcome (c^*, p^*) of the PEG can be characterized as follows:

- (i) For each individual legislator a shadow income m_i^* and a vector of shadow prices $\lambda_i^* = \{\lambda_{i1}^*, \dots, \lambda_{im}^*\}$ exist, such that it holds:

$$(1 - \mu_{ij}^* + \mu_{ij}^* C_{ij}^*) \lambda_{ij}^* = \theta_{ij} m_i^*$$

$$p_j \geq \mu_{ij}^* \lambda_{ij}^* = \frac{\partial U_i(c^*)}{\partial C_{ij}^*}$$

$$(22) \quad (p_j^* - \mu_{ij}^* \lambda_{ij}^*) C_{ij}^* = 0$$

$$m_i^* = \sum_{j \in M} C_{ij}^a p_j^* + \sum_j (1 - \mu_{ij}^*) \lambda_{ij}^*$$

$$\mu_{ij}^* = \sum_{\substack{k \neq i \\ h \neq i}} \frac{C_{kj}^*}{\sum_{h \neq i} C_{hj}^*} |X_{kj} - X_{ij}|$$

- (ii) Assume for any legislator i that his ideal position equals 1, while the ideal position of all other legislator equal 0. Define α^{AWG} as the outcome reached according to the mean voter decision rule under this assumption given the equilibrium control distribution c^* . Obviously, α^{AWG} is only a function of legislators control demand c^i . Then, we can define m_i^{AGW} as the minimum income level a legislator i would need to reach the utility level u_i^* as follows:

$$m_i^{AGW} = \min \left\{ \sum_j C_{ij} \lambda_{ij} \mid \alpha^{AWG}(c^i) = \alpha^* \right\}. \text{ Given these definitions it holds in}$$

$$\text{equilibrium: } m_i^* = m_i^{AGW}.$$

- (iii) In the framework of PEG political power can be defined as actors potential to determine the final mean voter position. Therefore, political power is measured by the first summand of the shadow income m_i^* in eq. (22): $\sum_j C_{ij}^a p_j$. According to the definition of legislators' resource control c_i^a political power in the framework of PEG corresponds with the political power defined in the framework of NLG.

- (iv) According to point (ii) above, the second summand of the shadow income m_i^* corresponds to the external effects of political control demand of other

legislators and thus is a measure of luck. This component is c.p. the higher the closer a single legislators' ideal point is to the ideal point to other legislators demanding a high amount of political control. Accordingly, the luck component of the PEG directly corresponds to the luck component determined in the framework of the NLG.

- (v) Consider the case that political exchange occurs over different policy issues decided under different constitutional rules. Hence, the corresponding PEG is defined on the basis of two or more different NLG. In this case the power and luck concept of the PEG generalized the one of the NLG⁹.

Since the proof of proposition 4 follows straightforward from the equilibrium conditions, it is omitted here.

4 Empirical evidence

Beyond the theoretical expositions above, the crucial question regarding the ongoing discussion on the application of power indices to the European Union is: to what extent does the PEG correspond to legislative decision-making within the EU. In general, we do not intend to investigate this specific question for all legislative decision-making in the EU. We only analyze this questions for the specific case of the European Agricultural Policy (CAP). Nevertheless, we consider the CAP as a good example for legislative decision-making within the EU, since the CAP is certainly the most integrated and also most important EU policy accounting approximately for 50% of total EU budget.

To this end, we first discuss whether or to what extent the assumptions of the political exchange model match the reality of legislative decision-making of the CAP.

⁹ Interestingly, this kind of generalization was already suggested by Coleman (1971).

Next, we have to check to what extent the specific assumptions implying that political power corresponds to defined apriori voting power indices (Inclusiveness, Banzhaf or Shapley-Shubik) hold for legislative decision-making in the EU-system. Namely, we have to check if legislative decision-making corresponds with (1) a randomized restitution rule implying for all relevant political actors an equal probability to be selected to form a winning coalition and (2) if no stable stylized policy preferences of relevant political actors exists for the CAP. In particular, the second assumption excludes that the same legislators systematically are preference outliers or that stable coalitions among legislators are institutionalized like for example strong parties in national legislatures.

According to §43 of the EU-treaty the CAP is decided under the consultation procedure, e.g. the council decides on a proposal submitted according to the following decision rule: the council can accept the proposal of the commission qualified majority¹⁰ or the council can unanimously accept any other proposal made by a member of the council.

In contrast to a widely accepted interpretation of the consultation procedure, we do not interpret this procedure in the sense that the commission has the “[m]onopoly over introducing legislative proposals around which coalitions in the council form” (Garett and Tsebelis 1999: 301). In particular, this different interpretation is justified as follows. Generally, following Weingast et al. (1981) modeling legislative decision-making we take relevant sociological and political superstructures explicitly into account (see also Shapley/Shubik: 791). Furthermore, note that according to §208 EGV any national member can initiate the commission to make a proposal to any

¹⁰ For the EU-12 the qualified majority required 54 out of 76 votes, where the national members have had the following weights: France, Germany, Italy, United Kingdom: 10; Spain: 8; Belgium, Greece, the Netherlands and Portugal: 5; Denmark, Ireland: 3, and Luxembourg: 2. We gave the weights for the EU-12 although since 1995 the EU includes 15 members, since our empirical example is taken from the EU-12.

issue of it's concern¹¹. Hence, it seems much more conceivable to us, that winning coalitions are formed within a process of social interaction among political actors prior to any voting in the council. Obviously, in this interactive process any relevant actor, national members in the council and the commission, have the equal chance to form a winning coalition. Hence, overall it seems realistic to assume that legislative decision-making under the consultation procedure matches conditions of the NLG, i.e. like assumed in the simple non-cooperative game winning coalitions are formed in an interactive social process anteceding final voting in the council and national members in the council and the commission have equal chances to formulate a proposal and try to form a winning coalition around this proposal¹².

The second assumption regarding stable policy preferences is of particular importance, since if it would not hold, our uncertainty argument would no more apply. At a first glance it is tentative to conclude that especially the CAP is a good example for stable preference outliers. It is well known that via the CAP welfare has been constantly transferred among national member states separating a subset of net-receivers from a subset of net-payers. For example, Germany as well as the United Kingdom are both one of the biggest net-payers, while the Netherlands, Belgium and for many years France were constantly net-receivers of the CAP. Therefore, it seems straightforward to assume that one can identify stable and stylized policy preferences regarding the CAP, with net-receivers on the one side and net-payers on the other. But, in reality CAP is much more complicated than these simple calculations imply (see for example Koester 1976, 1996). Since the CAP is not a focus of the paper, we don't want to go into detail. Instead it should be sufficient

¹¹ Moreover, for specific policy issues the council can directly formulate a proposal (see §205(2) EGV).

¹² Of course, given the specific voting rule of the consultation procedure, the commission is in every possible winning coalition, except the one formed by an unanimous council, hence the commission has an extraordinary position according to the consultation procedure when compared to national members in the council, but exactly this is reflected in the power indices.

to demonstrate that there hardly can be found any stable preference formation regarding CAP) by presenting empirical data on policy positions of relevant actors of the CAP (see figure 2-4 in the appendix. For a more detailed analysis see Henning 2000, Henning/Wald 2000).

Given the expositions above, it can be concluded that legislative decision-making can generally be modeled within a political exchange approach. Next we will apply this approach to the CAP to test to what extent it fits real decision-making. To compare the empirical fit of the political exchange model, we have additionally applied to alternative models. First, a random choice model has been used as a base run model. In particular, in the random choice decisions were forecasted by an independent random choice of policy positions for every policy dimension. Further, an agenda setter model (ASM) was applied. In particular, decision forecasts of the ASM correspond to the proposal that maximizes the commissions' spatial utility function subject to the constraint that the selected proposal is at least supported by a qualified majority in the council, i.e. leads for a qualified majority to a higher utility when compared to the status quo.

In detail, models have been applied to forecast the so-called MacSharry reform from 1992. Altogether, the MacSharry reform of 1992 contained six regulations¹³. Since main conclusion do not change we will only report estimation results for the milk regulation in the following¹⁴.

Input data including actors ideal points x and salience (θ) for the different policy dimensions have been collected in personal interviews (see Pappi/Henning 1999,

¹³ Regulation EWG No.: 1765-66/92 reforming cereals, oil seeds and protein plants; regulation EWG No.: 2071-74/92 reforming milk, regulation EWG No.: 2066-68/92 reforming the beef sector, regulation EWG No.: 2069-70/92 reforming sheep&goat; regulation EWG No.: 2075/92 reforming the tobacco sector and a regulation on supporting measures.

¹⁴ All estimation results are reported in Henning (2000). Note that estimations in Henning 2000 neglected external effects, while estimation results presented here do explicitly take into account for external effects.

Pappi et al. 1998)¹⁵. Since the focus of our analysis lies on the empirical fit of the alternative models, we do not analyze estimation results in detail. Detailed estimation results¹⁶ are reported in table 3 of the appendix .

Table 1: Estimation results and goodness of fit* of PEG and ASM

	Model				
	PEG			ASM	real
<i>Policy-dimension**</i>	<i>Shaply-Shubik</i>	<i>Inclusiveness</i>	<i>Banzhaf</i>		
M1	-10.61	-9.26	-9.37	-19.66	-2.50
M2	-0.90	-0.76	-0.91	-2.44	-2.00
M3	3.49	4.19	4.57	0.52	5.00
M4	0.00	0.00	0.00	0.00	0.00
M5	114.97	114.97	114.97	115.00	115.00
M6	13.93	18.83	12.77	39.73	0.00
M7	65.65	63.87	65.26	40.00	80.00
Goodness of fit*	70.36%	71.39%	73.15%	4.08%	100.00%

* defined as relative improvement of a random choice prognosis, where general the fit of a model prognosis is measured by the Euclidian distance to the real decision.

** a specification of policy dimensions is given in the appendix.

According to table 1 the PEG delivers a much better prognosis when compared to the ASM. Overall, the best prognosis results for the Banzhaf-index, although differences in the goodness of fit are marginal for the different voting power-indices. Thus, given these results we clearly can conclude that the political exchange model is a much more realistic model for the legislative decision-making process than the agenda setting model suggested by Garrett and Tsebelis. This holds especially true, when we analyze decision prognoses for single policy dimension. For example, the reduction of intervention prices for milk (M1) is by far the most important policy dimension. Here,

¹⁵ On request detailed input data and output results are available from the authors.

¹⁶ Political exchange equilibrium including external effects has been formulated as a mixed complementary programming problem that could be solved in GAMS using the path-solver (see Ferris/Munson 2000). I would like to thank Tom Rutherford and Michael Ferris who supported me writing a GAMS-program to calculate the political exchange equilibrium in GAMS.

the commission has a clear outlier position demanding a reduction by -22.5 p.a., while the maximum reduction preferred by national members in the council is -10 p.a. (see input data in the appendix). Assuming the commission has full agenda setter power would imply that the commission could almost realize her ideal position given a reduction of -19.6 p.a. for the ASM. In contrast, on the basis of PEG forecasts are much more realistic reduction of the milk price ranging from -11 p.a. to -9.3 p.a..¹⁷

One more comment should be made regarding the goodness of fit of the PEG in comparison to the ASM. The low empirical fit of the ASM is a general result, e.g. applying the ASM to all 6 regulations of the MacSharry reform resulted in a total goodness of fit of only 6.7 p.a. (Henning 2000: 221). Note, that for specific single regulations, e.g. beef, even a negative goodness of fit was observed for the ASM. In contrast, goodness of fit remains high for the political exchange model, ranging from 44 p.a. for beef to 80 p.a. for sheep and goat. Overall, it is fair to say that empirical results convincingly supported the political exchange approach, while for the agenda setter model no satisfying empirical results could be observed.

Finally, a short comment on the empirically derived values of relative power and luck in the CAP should be made. Table 2 presents total shadow income, resource income and the shadow income corresponding to external effects of exchange for the different actors. According to the exposition above the relative resource income of an individual actor equals his assumed power index (which is the Banzhaf index in table 2). As has been discussed many times in the literature, for the consultation procedure the highest power is observed for the commission possessing roughly

¹⁷Nevertheless, one has to admit that regarding the specific policy dimension of milk price reduction also the forecast of PEG does not fully match the real decision (see table 1). One reason for the relatively low fit follows from the fact that we calculate the political exchange equilibrium taking only the milk policy dimension into account, while all other policy issues of the MacSharry reform have been neglected. Taking additional policy exchange over other sector policies into account partially improves model forecast, e.g. for the full model a milk price reduction of only -4.5 p.a. resulted (see Henning 2000). Moreover, empirical analysis underlines a significant impact of lobbying activities in the CAP (see Henning 2000). Lobbying activities are generally neglected in the calculation presented here, while these are included in Henning 2000.

15% of total political resources, while power of the member states in the council varies from 1.6 p.a. for Luxembourg with only 2 votes to 10.9 p.a. for the 10 vote members, namely France, Germany, Italy and the United Kingdom.

Table 2: Power and luck in the CAP

Actors	Total shadow income	Ressource Income	External effects	Share
	<i>M_i</i>	<i>Power</i>	<i>luck</i>	<i>power/luck</i>
Bel_Min	22.43	1.05	21.38	20.4
Dan_Min	22.20	0.72	21.48	29.7
Ger_Min	9.17	2.01	7.16	3.6
Fra_Min	21.28	2.01	19.27	9.6
GR_Min	7.07	1.04	6.03	5.8
Irl_Min	12.12	0.72	11.40	15.8
Ita_Min	6.45	2.01	4.43	2.2
Lux_Min	15.41	0.29	15.12	52.9
Ned_Min	17.82	1.05	16.77	16.0
Por_Min	6.53	1.05	5.48	5.2
Spa_Min	9.69	1.70	7.98	4.7
GB_MIN	9.09	2.01	7.08	3.5
Commission	10.00	2.81	7.19	2.6

Interestingly, as Barry (1980) already argued power is not the most determining factor regarding actors' satisfaction with the outcome of political decisions. As can be seen, luck is generally much more important. Given the values presented in table 2, the most lucky actors in milk policy are Luxembourg, Belgium and Denmark. Note that for example Luxembourg and Denmark would need an almost 30 times and 52 times higher resource income, respectively, to reach their utility levels derived in the present exchange equilibrium, if positive external effects of the control demand of other actors are neglected. In contrast, Italy and the commission, respectively, are

less lucky needing only a 2.2 times higher income, if external effects would be neglected. The same holds true for Germany and the United Kingdom.

5 Summary

Stimulated by an on-going dispute on the application of political power indices to legislative-decision-making the EU in this paper a political exchange model of legislative decision-making has been derived based on non-cooperative game theory that allows for a derivation of political power indices. In particular, it has been demonstrated that this model can be applied empirically to the EU predicting *pari pro toto* real policy decision of the CAP. The political exchange approach has been derived in two steps. First, assuming policy preferences are private knowledge a non-cooperative legislative bargaining game (NLG) has been defined and the following results were proved: (i) The equilibrium outcome of the NLG corresponds to a lottery over legislators ideal points and the status quo; (ii) the probability that the ideal point of a legislator i is the final outcome of the game is determined by the constitutional rules of the legislature. The relative individual probability of a legislator can be interpreted as its political power and hence defines her political power index. (iii) on the basis of the NLG power can be systematically distinguish from luck the latter defined on the basis of individual expected utility corresponding with a lottery over the ideal points of other legislators' and the status quo. (iv) under specific conditions political power in the NLG corresponds with the classical Banzhaf and Shapley-Shubik voting power index, respectively.

In a second step we demonstrate that there exists a political exchange game (PEG) that dominates the NLG, i.e. leads to every legislator to a higher *ex ante* expected utility. According to the PEG legislators informally agree on a common proposal procedure, where the common proposal opposed *vis-a-vis* the status quo in final vote

corresponds with a weighted mean of agent's ideal points. In detail, the PEG corresponds with a centralized political exchange mechanism, in which agent demand for individual weights regarding various dimensions of a multidimensional policy proposal. In equilibrium of the PEG legislators' ability to determine the final policy outcome can be subdivided into an institutionally determined political power component and a luck component corresponding to the externalities of political exchange of other legislators. Furthermore, it was argued that political power defined in the framework of the PEG generalized the power concept defined in the framework of the NLG. Beyond theoretical considerations empirical evidence for the PEG was delivered in section 4. In particular, empirical results imply a convincing support of the PEG, while for the agenda setter model, which has been suggested by Garrett and Tsebelis, only a poor empirical support was received.

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Appendix

Proof of Proposition 1:

(i) According to the structure of the game, a recognized legislator chooses a proposal $x \in R^m$ maximizing his expected payoff:

$$EU_i = P_i(x_i)U_i(x_i) + (1 - P_i(x_i))v_i$$

$$\text{with : } P_i(x_i) = \sum_{i \in G} \prod_{j \in G} \int_0^1 f^{ij}(x_i) p_{ij} dp_{ij} \prod_{k \notin G} \left(1 - \int_0^1 f^{ik}(x_i) p_{ik} dp_{ik} \right)$$

As it holds for $x \notin H(s)$ that $f^{ij}(x_i) = 0$ and for any $x, x' \in H(s)$ f^{ij} is a uniform distribution for all $i, j \in N$, thus it holds:

$$P_{ij} = \int_0^1 p_{ij} dp_{ij} = 0.5$$

Therefore, it follows: $P_i(x) = P_i(x') = \sum_{i \in G} 0.5^n = 0.5^n g_i \quad \forall x \in H(s)$

where, $g_i \in N$ denotes the number of winning coalitions, in which legislator i is a member. Hence, it follows directly that in every subgame each recognized legislator i will propose the maximand of his utility function over $H(s)$, that is x_i . To establish necessity notice that all subgames are identical. Let v_i denote the stationary continuation value for a legislator $i = 1, \dots, n$ for each subgame. Then it follows for the continuation values:

$$\begin{aligned} v_i &= \frac{1}{n} \sum_k P_k U_i(x_k) + v_i p_T \frac{1}{n} \sum_k (1 - P_k) + (1 - p_T) \frac{1}{n} \sum_k (1 - P_k) U_i(s) \\ \Leftrightarrow \\ v_i &= \frac{\frac{1}{n} \sum_k P_k}{1 - p_T + p_T \frac{1}{n} \sum_k P_k} \sum_k \frac{P_k}{\sum_k P_k} U_i(x_k) + \frac{(1 - p_T) \left(1 - \frac{1}{n} \sum_k P_k \right)}{1 - p_T + p_T \frac{1}{n} \sum_k P_k} U_i(s) \end{aligned}$$

(ii) The ex ante probability Q_s that the status quo will be the outcome of the legislative game is given by the following equation:

$$Q_s = (1 - p_T) \frac{1}{n} \sum_k (1 - P_k) \sum_{t=0}^{\infty} \left[\frac{1}{n} \sum_k (1 - P_k) p_T \right]^t = \frac{(1 - p_T) \left(1 - \frac{1}{n} \sum_k P_k \right)}{1 - p_T + p_T \frac{1}{n} \sum_k P_k}$$

(iii) Accordingly, the ex ante probability that the proposal x_i will be the outcome of the legislative game is given by the following equation:

$$Q_i = \frac{1}{n} P_k \sum_{t=0}^{\infty} \left[\frac{1}{n} \sum_k (1 - P_k) p_T \right]^t = (1 - Q_s) \frac{P_i}{\sum_k P_k} = (1 - Q_s) \frac{g_i}{\sum_k g_k} = (1 - Q_s) C_i$$

(iv) Finally, it follows directly from (i) and (iii) that it holds for the values of the game:

$$v_i = (1 - Q_s) \sum_k C_k U_i(x_k) + Q_s U_i(s).$$

Q.E.D.

Proof of proposition 2

(i) According to the structure of the game NLG1, a recognized legislator chooses a proposal $x \in R^m$ maximizing his expected payoff:

$$EU_i = P_i(x_i)U_i(x_i) + (1 - P_i(x_i))v_i$$

$$\text{with : } P_i(x_i) = \sum_{i \in G} \prod_{j \in G} \int_0^1 f^{ij}(x_i) p_{ij} dp_{ij} \prod_{k \notin G} \left(1 - \int_0^1 f^{ik}(x_i) p_{ik} dp_{ik} \right)$$

As it holds analogously to NLG for $x \notin H(s)$ that $f^{ij}(x_i) = 0$ and for any $x, x' \in H(s)$ f^{ij} is a uniform distribution for all $i, j \in N$, thus it holds:

$$P_{ij} = \int_0^1 p_{ij} dp_{ij} = 0.5$$

As by assumption legislators only approve winning coalitions in which the agenda setter is a decisive member it directly follows: $P_i(x) = P_i(x') = \sum_{i \in G} 0.5^n = 0.5^n g'_i \quad \forall x \in H(s)$

where, $g'_i \ i \in N$ denotes the number of winning coalitions, in which legislator i is a decisive member.

The residual statements in proposition 2 follow directly from the proof of proposition 1.

Q.E.D.

Proof of proposition 3:

We only have to be shown that under the homogeneity assumption the process of legislators' belief formation results in the Shapley-Shubik values. According to the structure of the NLG1 a recognized legislator chooses a proposal $x \in R^m$ maximizing his expected payoff:

$$EU_i = P_i(x)U_i(x) + (1 - P_i(x))v_i$$

Now, under the homogeneity assumption it holds for P_i :

$$\begin{aligned}
P_i(x) &= \sum_{i \in g' \in G} \int_0^1 p^{r^g-1} (1-p)^{n-r^g} dPp \\
&= \sum_{i \in g \in G} \frac{(r^g-1)!(n-r^g)!}{n!} = \Phi_i
\end{aligned}$$

where r^g denotes the number of members in the winning coalition g' . g' denotes a winning coalition in which legislator i is a decisive member. Note that the last transformation results from the beta-function identity (see Straffin 1988: 76). The rest of proposition 3 follows directly from the proof of proposition 1. Note that the sum of the Shapley-Shubik indices of all legislators equals 1, therefore it can be substituted in eq. (13) of proposition 3.

Q.E.D.

Figure 1: Game-tree of the non-cooperative bargaining game

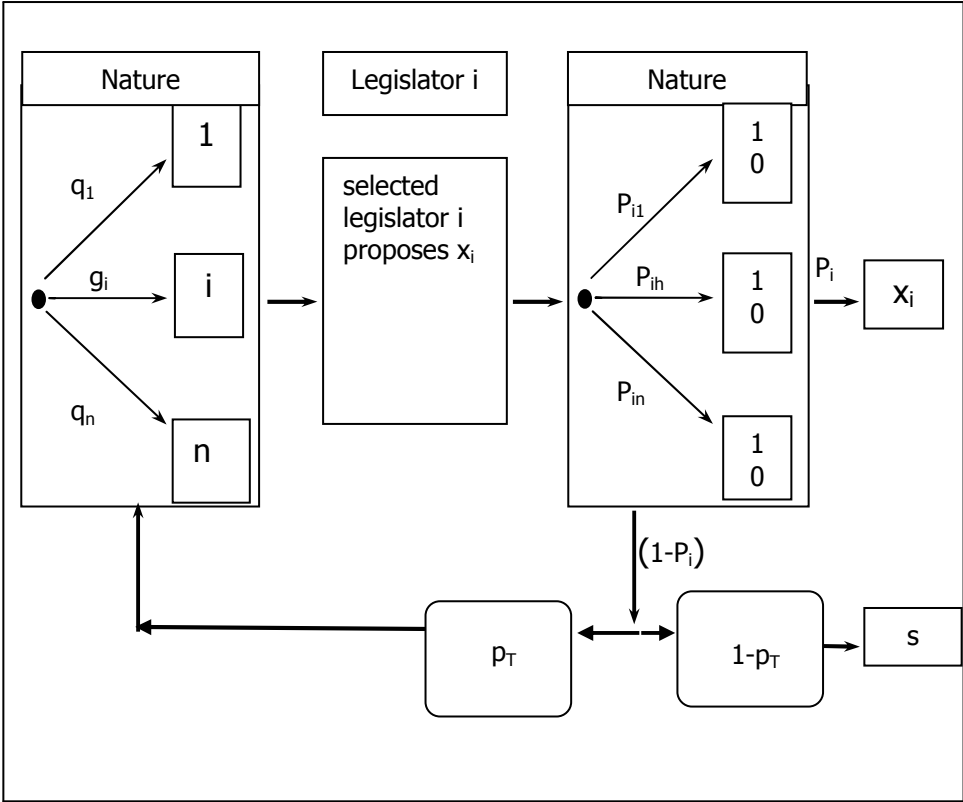
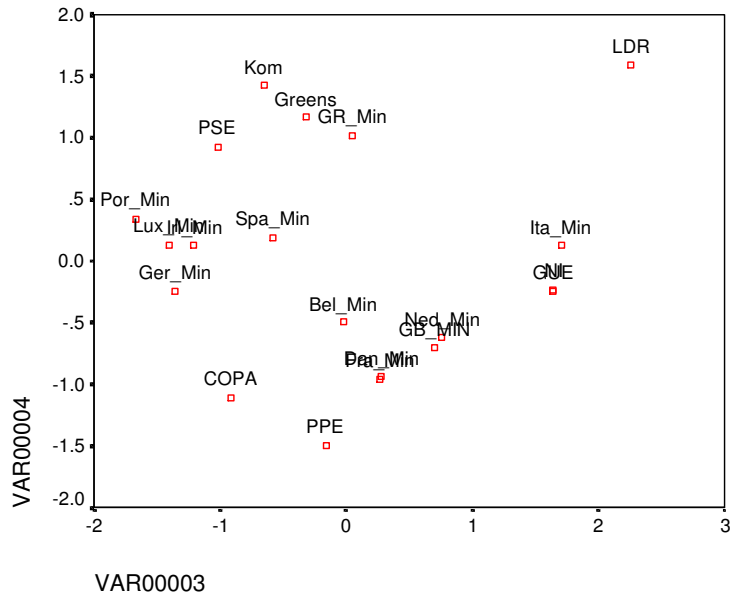
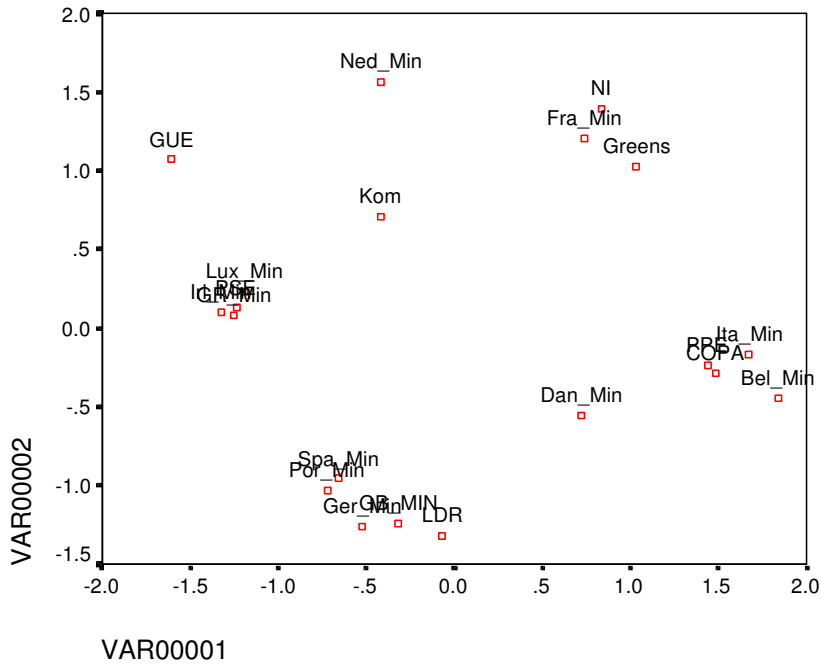


Figure 2: Policy-position in the European Agricultural Policy: milk policy



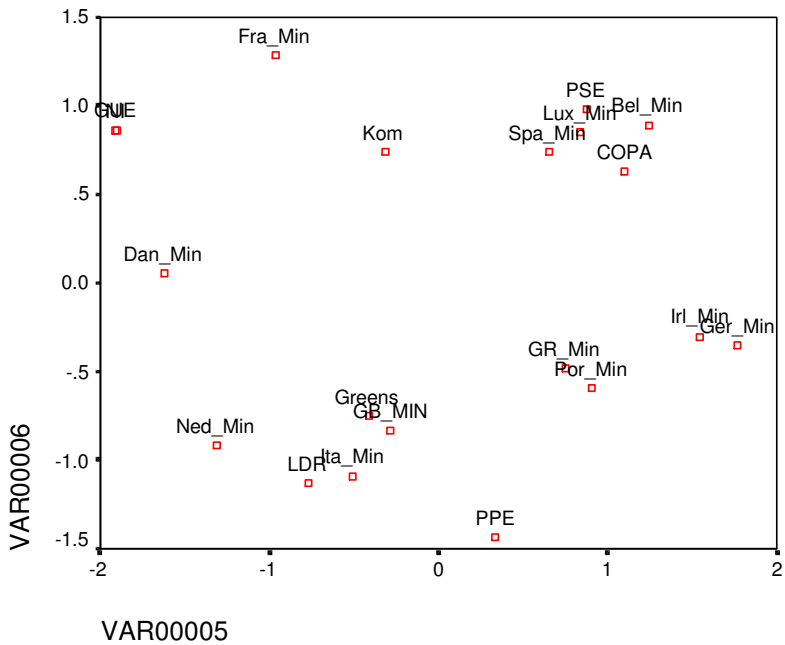
Source: MDS-analysis calculated on the basis of own interview data

Figure 3: Policy-position in the European Agricultural Policy: cereal policy



Source: MDS-analysis calculated on the basis of own interview data

Figure 4: Policy-position in the European Agricultural Policy: beef policy



Source: MDS-analysis calculated on the basis of own interview data

Table 3: Estimation results of the political exchange equilibrium based on the Banzhaf-index

	Policy dimensions*						C ^a
	M1	M2	M3	M4	M5	M6	
	<i>Political control demand</i> (C _{ij} [*])						
Bel_Min	0.223			0.002			0.056546
Den_Min		0.187					0.039089
Ger_Min			0.571		0.029		0.108918
Fra_Min	0.35			0.998			0.108918
GR_Min		0.073	0.225				0.056546
Irl_Min					0.249		0.039089
Ita_Min					0.695		0.108918
Lux_Min	0.061						0.015560
Ned_Min		0.193				0.091	0.056546
Por_Min					0.027	0.295	0.056546
Spa_Min		0.44					0.092220
GB_Min						0.614	0.108918
Commmission	0.365	0.107	0.203				0.152182
Total	1	1	1	1	1	1	1
Prices	4.685	3.871	3.379	0.374	2.898	3.28	

Source: own calculations

* Policy Dimensions of the milk regulation EWG No.: 2071-74/91:

M1 = Target price reduction in %

M2 = Quota reduction in %

M3 = Compensatory payment for quota reduction in ECU/100 kg quota

M4 = Additional levy in % of target price

M5 = Milk cow premium as a refund for target price reductions in ECU/cow

M6 = Limit for a premium for milk cows in number of cows (numbers higher than 80 indicate no limit).